

linguistic and diagrammatic representations? Larkin and Simon (1987) considered diagrams and linguistic representations that are informationally equivalent and analyzed how they can nonetheless differ with respect to ease of search, pattern recognition, and the inference procedures that can be applied to them. In part these differences stem from the fact that information that may be only implicit in a linguistic representation may be made explicit, and hence easier to invoke in reasoning, in a diagram (Larkin & Simon, 1987, p. 65).¹³ More recently, Stenning and Lemon (2001) suggested that diagrams are more constrained in expressive power than propositions and accordingly are more tractable. They also argued that the advantage provided by these constraints is dependent upon the subject supplying an interpretation that makes them available.

5. LEVELS OF ORGANIZATION AND REDUCTION

The part-whole relationship between a mechanism's component parts and its structure can be understood as falling within the type of hierarchical, mereological framework that systematic biologists and others have long used to bring orderliness to types of entities at different levels. The relationship between a mechanism's component operations and its overall function have roughly the same character, though less attention has been paid to systematizing this kind of relationship. What is important here is that both kinds of components (the parts and their operations) can be regarded as occupying a lower level than the mechanism itself (a structure with a function). Because of this difference in levels, mechanistic explanations are commonly characterized as *reductionistic*.¹⁴ The notion of reduction that arises with mechanistic explanation, however, is very different from that which has figured either in popular discussions or in recent philosophy of science, and its consequences are quite different. In these discussions, appeals to lower levels are thought to deny the efficacy of higher levels. While the functioning of a mechanism

¹³ Larkin and Simon commented, "In the representations we call diagrammatic, information is organized by location, and often much of the information needed to make an inference is present and explicit at a single location. In addition, cues to the next logical step in the problem may be present at an adjacent location. Therefore problem solving can proceed through a smooth traversal of the diagram, and may require very little search or computation of elements that had been implicit" (1987, p. 65).

¹⁴ Wimsatt (1976) was one of the first philosophers to recognize the relation between mechanism and what most scientists mean by *reduction*: "At least in biology, most scientists see their works as explaining types of phenomena by discovering mechanisms, rather than explaining theories by deriving them or reducing them to other theories, and *this* is seen as reduction, or as integrally tied to it" (p. 671).